

CLAIMS:

1. A deformable mirror, characterized by including:
a reflection mirror having a reflection surface on which light is reflected, at least part of which is made of a member having ferromagnetism; and

a switching device that switches between a deformed state and a non-deformed state of the reflection mirror with a magnetic force,

wherein the switching device includes a hard magnetic member and a magnetizing member that magnetizes and demagnetizes the hard magnetic member.

2. The deformable mirror according to Claim 1, wherein:
the reflection mirror is brought into the deformed state by attracting the member having ferromagnetism in the reflection mirror as the hard magnetic member is magnetized by the magnetizing member, and the reflection mirror is restored to the non-deformed state as the hard magnetic member is demagnetized by the magnetizing member.

3. The deformable mirror according to Claim 1, wherein:
the magnetizing member includes a yoke, a magnetizing coil, and a sub-coil.

4. The deformable mirror according to Claim 3, wherein:

at least part of the sub-coil and the yoke is disposed on a back surface and a side portion of the reflection mirror.

5. A deformable mirror, characterized by including:

a reflection mirror having a reflection surface on which light is reflected, at least part of which is made of a member having ferromagnetism; and

a switching device that switches between a deformed state and a non-deformed state of the reflection mirror using a magnetic force,

wherein the switching device includes a permanent magnet, and a movable mechanism that moves the permanent magnet between a first position at which a magnetic force acts on the reflection mirror and a second position spaced apart farther from the member having ferromagnetism than the first position.

6. The deformable mirror according to Claim 5, wherein:

the movable mechanism brings the reflection mirror into the deformed state by attracting the member having ferromagnetism in the reflection mirror by moving the permanent magnet present at the second position to the first position, and restores the reflection mirror to the non-deformed state by moving the permanent magnet present at the first position to the second position.

7. The deformable mirror according to Claim 5 or 6, wherein:

the movable mechanism includes a movable portion that supports the permanent magnet, a fixing portion that supports the movable portion rotatably, and a driving portion that activates the movable portion to rotate between the first position and the second position.

8. The deformable mirror according to Claim 7, wherein:

at least part of the driving portion is disposed on a side portion of the reflection mirror.

9. The deformable mirror according to Claim 7 or 8,

wherein:

the driving portion includes a yoke that attracts the permanent magnet present at the second position, a driving coil attached to the yoke, and a driving magnet.

10. The deformable mirror according to any one of Claims 1 to 9, wherein:

the reflection mirror includes a base member comprising a glass plate; and

the member having ferromagnetism is provided to at least part of the base member.

11. The deformable mirror according to any one of Claims 1 to 9, wherein:

the reflection mirror uses a plate material having ferromagnetism as a base member.

12. The deformable mirror according to Claim 3 or 9, wherein:

the member having ferromagnetism together with the yoke forms part of a magnetic circuit.

13. The deformable mirror according to Claim 10 or 11, wherein:

the reflection surface comprises a reflection coating provided on a surface of the base member.

14. The deformable mirror according to Claim 13, wherein:
the reflection coating comprises a dielectric multi-layer film.

15. The deformable mirror according to Claim 13 or 14, wherein:

the reflection coating is provided on each of both surfaces of the base member.

16. The deformable mirror according to Claim 13 or 14,

wherein:

the reflection coating is provided on one surface of the base member; and

a counter coating, having a coefficient of thermal expansion same as a coefficient of thermal expansion of the reflection coating, is formed on the other surface of the base member.

17. The deformable mirror according to any one of Claims 1 to 16, wherein:

the member having ferromagnetism is made of a hard magnetic material.

18. The deformable mirror according to any one of Claims 1 to 17, further including:

a base; and

a holding member supported on the base,

wherein:

the reflection mirror is held elastically by the holding member; and

the switching device is incorporated into the base.

19. The deformable mirror according to Claim 18, wherein:

the base is provided with a recessed portion that is recessed in a deforming direction of the reflection mirror;

and

the reflection mirror is configured to be held so as to cover the recessed portion in the base, and maintained in the deformed state by abutting on the recessed portion when deformed by means of the switching device.

20. The deformable mirror according to Claim 19, wherein:

the reflection mirror is formed in almost an elliptical shape; and

the recessed portion in the base is formed in almost an elliptical shape adjusted to a shape of the reflection mirror.

21. The deformable mirror according to any one of Claims

18 to 20, wherein:

the holding member presses the reflection mirror toward the base with a spring force.

22. The deformable mirror according to Claim 21, wherein:

the holding member includes a base portion incorporated into the base, a blade spring portion extending from the base portion, and a presser frame portion connected to the blade spring portion and pressing down the reflection mirror.

23. The deformable mirror according to any one of Claims

18 to 20, wherein:

the holding member is made of an elastic adhesive.

24. An optical head configured to concentrate light on an optical information recording medium, the optical head being characterized by including:

an objective lens that concentrates light on the optical information recording medium;

an objective lens actuator that drives the objective lens; and

the deformable mirror according to one of Claims 1 to 23,

wherein the deformable mirror is disposed to reflect light emitted from a light source toward the objective lens.

25. The optical head according to Claim 24, wherein:

the deformable mirror is provided in a space below the objective lens actuator.

26. An optical recording and playback device that concentrates light on an optical recording and playback medium having two recording layers and performs at least one of recording information in and reading recorded information from the optical recording and playback medium, the optical recording and playback device being characterized by including:

the optical head according to Claim 24 or 25; and
a feeding portion that supplies the optical head with
power needed to switch the states of the reflection mirror.

27. The optical recording and playback device according
to Claim 26, wherein:

the deformable mirror uses the reflection mirror as a
plane mirror when light is concentrated on a first recording
layer farther from a light-incident surface, and deforms the
reflection mirror to be a concave mirror with the reflection
surface forming a concave surface when light is concentrated
on a second recording layer closer to the light-incident
surface.

28. The optical recording and playback device according
to Claim 26 or 27, wherein:

the feeding portion applies a pulse of voltage only when
the states of the reflection mirror are switched.